

# Health-Care Quality Promotion through Infection Prevention: Beyond 2000

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Health-care value purchasing, complex health-care systems, and information technology are the three most important change drivers influencing the interrelated themes of the 4th decennial conference: accountability, quality promotion through infection prevention across the health-care delivery system, and medical informatics. Among the change drivers influencing themes of future conferences may be a societal mandate for health promotion and health-care access for all.

Tempora mutantur, nos et mutamur in illis.  
Times change, and we change with them.  
Owen's Epigrammata, 1615

Globalization, population demographics, and biotechnology are examples of change drivers that influence our social lives, businesses, and government. These forces create a changing environment to which organizations must adapt. Change drivers also affect our health-care system and were reflected in the themes of this decennial conference.

In 1970, the rising cost of medical care in the fee-for-service environment was a major change driver. Risk management also became an important force, in response to the increase in medical malpractice claims and awareness that health care-associated infections could lead to litigation. In 1970, reducing the frequency of both endemic and epidemic hospital infections was emphasized, as well as emerging pathogens and antimicrobial-drug resistance (1).

Ten years later, health-care economics was still an important force, this time manifest by the onset of prospective reimbursement and diagnosis-related groups as the basis for payment. In addition, standards for hospital accreditation relevant to infection control had a major impact on the profession. The 1980 themes included the critical role of surveillance and infection control personnel in preventing infection and the importance of risk stratification in interpreting infection rates (2).

By 1990, the broadening market penetration of managed care and the reduced emphasis on hospital in-patient care were key change drivers. The effects of the "quality assurance movement" were also evident, along with the enormous impact of the HIV epidemic. A major theme in 1990 was increasing severity of illness and hence, increasing infection risk among hospital patients (3). For the first time, infections in nonhealth-care settings received attention, as well as occupational infections, including HIV and other bloodborne pathogens.

Among many factors influencing the profession of health-care epidemiology and infection control in the 1990s, three were deemed to have the most potent impact: health-care

value purchasing, the increasing complexity of health-care systems and health care, and advances in medical information technology. Hence, three major themes emerged: accountability, or demonstrating the attributable impact of infections and the cost-effectiveness of prevention interventions; extension of health-care quality promotion and infection prevention programs to include the entire health-care delivery system; and innovative uses of medical informatics to enhance the overall impact of our profession.

## Health-Care Value Purchasing

Health-care expenditures are once again increasing at an alarming rate, despite extensive efforts to control costs through managed care and other strategies. Consumers, third-party payers, and politicians are demanding that the delivery system be accountable for the value of these expensive purchases. Health-care value in simple terms is directly proportional to quality and inversely proportional to cost. Ideally, the goal is to obtain the highest quality health care at an affordable price. From the business perspective, as the cost of health care per covered employee life increases, corporate profit margins shrink. Investments in high-quality prevention and care services that reduce the need for more expensive care in the future make good business sense for employers. Hence, many corporations have a strong incentive to maximize both short- and long-term value of the health-care benefits they purchase for employees. As a result, large purchasing coalitions have emerged and now exert considerable influence on the prevention and treatment services provided by the health plans they support.

## Accountability in Health-Care Quality Promotion

Value purchasing is driving major changes in the delivery system and new standards for the entire health-care industry. To survive in this environment, we must first provide the evidence that quality promotion and infection prevention programs contribute to health-care value and then help shape new standards for quality and safety. The first major conference theme, accountability, is a direct response to the powerful influence of value purchasing on our profession. Accountability requires documenting the attributable impact of health care-associated infections on health-care outcomes and cost. We must measure the impact of infections on patient outcomes, satisfaction, and cost of care through credible

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research and use this information to justify goals for prevention interventions and the need for resources.

Evidence alone is not sufficient to convince decision-makers that infection prevention is a critical component of quality promotion and adds value to the delivery system. We must effectively communicate this information, not only to our traditional constituents, but also to health-care administrators, organizations, accreditors, regulators, and perhaps most importantly, purchasers and consumers. Effective communication will require some revision in our vocabulary and a “multilingual” approach that includes concepts traditionally embraced by other disciplines.

Health-care epidemiologists and infection control professionals are in the business of infection prevention. Quality managers and accreditors are in the business of continuous quality improvement. Health-care purchasers and consumers are in the business of promoting patient safety and health-care value. Each of these three groups has its language (Table), but essentially all are talking about the same things.

“Nosocomial” is a word with a precise meaning that remains obscure to many within the health-care system and to most outside of it. “Surveillance” is another term that effectively communicates an important concept within our profession but has completely different meanings outside the epidemiology and public health community. We accept the concept that some health care-associated infections are preventable. However, when this same concept is presented as “some health care-associated infections are due to medical errors,” many are not so accepting. Until we achieve a “no name, no blame, no shame” atmosphere, “medical error prevention” perhaps should be framed as “patient safety promotion.” Words that obscure the problem, miscommunicate our purpose, or alarm constituents must be avoided if we are to convince decision-makers to invest in our prevention programs.

Accountability also requires that the success (or failure) of quality promotion efforts, including infection prevention programs, be measured. Proposed measurements of quality generally encompass three main areas: health-care outcomes and cost, processes of care that serve as indicators or surrogates of outcomes, and patient or consumer satisfaction.

Traditional health-care epidemiology has not emphasized measurement of outcomes or patient satisfaction. We do

have enormous expertise in measuring processes of care (e.g., infection rates, invasive device utilization, antimicrobial-drug use). In addition, we have considerable experience in creating scientifically valid performance measures and benchmarks for intramural or external comparisons. The National Nosocomial Infections Surveillance (NNIS) system is perhaps the largest and certainly the longest ongoing system for monitoring adverse events in hospitals. In the 1990s, rates of infections monitored in NNIS hospitals declined by >30%, suggesting that NNIS benchmarking is an effective quality promotion program in facilities that have invested in the infection control staff necessary for participation (4). Preliminary data also suggest that performance measurement, benchmarking, and feedback systems can improve antimicrobial-drug use and reduce antimicrobial-drug resistant infections among intensive care patients. This approach is likely to have broad utility in preventing adverse events and promoting patient safety in other domains and venues.

Measuring adverse event rates is most appropriate when the numerator is not expected, at least in the short run, to be zero (i.e., when there is a reasonable expectation that an event occurs often enough to merit attention and is not entirely preventable). Health care-associated infections certainly fall into this category, as do many other complications of health care. From the perspective of those responsible for ensuring quality care to a population of patients, monitoring and comparing rates can be extremely helpful in diagnosing the need for prevention programs at the local level. Likewise, facilities with rates well below those observed in comparable facilities serving comparable patients can be confident that their care is not deficient in that dimension.

However, we must also consider the perspective of the individual patient, who is much more concerned about the cause and consequences of his or her infection than with the facility’s infection rate. Even in facilities with low infection rates, some individual infections are likely to be preventable. Overreliance on rates can create complacency and lost opportunities to learn from these events and prevent them in the future. The Institute of Medicine report “To Err is Human—Building a Safer Health System” drew national attention to the relevance of this perspective and has legitimized the value of assessing the causes of individual adverse events, errors, and near-misses (5). Likewise, the Joint Commission on Accreditation of Health-Care Organizations requires facilities to investigate sentinel events, identify their root causes, and take action to prevent them in the future (see URL: [www.jcaho.org/sentinel/sentevnt\\_frm.html](http://www.jcaho.org/sentinel/sentevnt_frm.html).)

Table. Perspectives on health-care quality

Perspective	Infection control	Continuous quality improvement	Patient safety
Focus	Adverse health events	Indicators	Errors, near misses
Determinants	Risk factors	Patient mix	Root cause, human factors
Monitoring	Surveillance, response	Performance measurement, improvement	Reporting, learning
Goal	Prevention	Performance improvement	System improvement
Key professionals	Health-care epidemiologists, infection control professionals	Quality managers, accreditation officials	Systems engineers, health-care purchasers, consumers

### Complexity of the Health-Care Delivery System

An elderly patient admitted to a hospital with severe community-onset pneumonia may be evaluated in the emergency department, visit the radiology department for a state-of-the-art imaging procedure, and then be admitted to the intensive care unit for mechanical ventilation. Once stable, the patient could have a brief stay in a step-down unit before being transferred to a medical ward. Movement from one room to another or from one ward to another is likely because bed or room changes often are needed to accommodate staffing shortages or isolation room requirements. As soon as possible, the patient will be transferred to a skilled nursing facility and then finally, if all goes well, to home care or home with ambulatory care follow-up. Along the

way, the patient will have contact with many health-care personnel, including nurses, respiratory therapists, technicians, phlebotomists, dietitians, housekeepers, physicians, consultants, fellows, house staff, and students. In addition, the patient will encounter an amazing array of medical devices and monitors, undergo dozens of laboratory tests, and receive numerous oral and intravenous medications.

The systems of health-care delivery, for even a fairly simple problem, are both dynamic and incredibly complex. Patient transfers and complicated interactions between patients, personnel, and the processes of care (each allowing opportunities for adverse events or errors) present formidable challenges to quality health care and effective intervention programs. Clearly, the increasing complexity of health care is a major change driver affecting virtually every domain of our profession.

### Quality Promotion through Infection Prevention across the Spectrum of Health-Care Delivery

The urgent need for enhanced infection prevention programs in nonhospital settings has been acknowledged for more than a decade. However, programs to effectively address this need have been slow to evolve because of lack of information about the incidence and impact of infections; lack of validated methods to monitor infections, antimicrobial-drug use, and resistance; and lack of evidence to document the cost-effectiveness of prevention programs outside hospitals. These deficits can be overcome with research, demonstration programs, and other creative enterprises. However, some contributing factors present more difficult challenges: scant resources for hiring and developing the needed staff; lack of regulatory and accreditation standards to ensure that truly effective program components are in place; and perhaps most importantly, lack of focused leadership and commitment from professional and governmental organizations.

The complexity of the delivery system demands new strategies to achieve meaningful improvements in quality and patient safety. The movement of patients through various health-care settings provides strong support for integrating prevention programs to encompass the entire system of care. Until the patient or patient population, rather than the venue of care, is seen as the organizing principle for these activities, effectiveness will be compromised and new prevention opportunities will be missed. For example, monitoring programs may need to measure not only the use of antimicrobial drugs in the intensive care unit, but also their use in patients with diabetes or in geriatric patients as they move in and out of various venues of care. If trends toward increased integration of care continue, then integrating infection prevention and quality promotion efforts will be essential.

### Information Technology

The computer age slowly emerged during the last three decades. The 1970 proceedings include a paper describing the use of computer-compatible formats for infection surveillance (6). By 1980, many hospitals had computerized laboratory information systems sufficient to conduct some laboratory-based surveillance and monitor antimicrobial-drug susceptibility. By 1990, systems had evolved to include consideration of the electronic medical record as a key component of surveillance and intervention programs. However, the

computer age has clearly given way to the explosive onset of the information age. In 2000, we have access to more information than we dreamed possible even 5 years ago, we can instantaneously exchange that information with anyone, and we can disseminate useful prevention tools anywhere in the world. We are enjoying the benefits of a technologic capacity that far exceeds our own capacity to make effective use of it, a capacity that will revolutionize our profession.

### Quality Promotion through Informatics

Medical informatics is the scientific field that uses computer technology and communication systems to retrieve, exchange, and optimize use of biomedical information and data for making health-care decisions and solving problems. Computer order entry, on-line decision support, and immediate feedback about treatment decisions are now recognized as key opportunities for improving medical care. With the advent of integrated systems, data repositories, and robust analytic tools, electronic surveillance for infections, antimicrobial-drug resistance, and related adverse health events is a realistic goal.

The technology to create local, regional, national, and international networks for communicating health information and providing decision support already exists. E-mail, list-serves, and other informal networking strategies are in wide use. Plans are already under way for integrated state-based electronic notifiable disease reporting, which includes electronic laboratory data reporting protocols (See URL: <http://www.cdc.gov/nchs/otheract/phdsc/presenters/medss.pdf>). Programs to link local users in health-care facilities with local and state health departments and CDC have received increasing priority and funding as a component of bioterrorism preparedness and response activities (See URL: <http://www.phppo.cdc.gov/han/>). Creating effective internet-based bidirectional communication channels between the health-care delivery system and the public health system is likely to optimize detection, prevention and control of many emerging health problems.

A complex system such as health-care delivery involves factors that interact in a very complicated manner. Reducing a complex system to its simplest terms (e.g., disease or no disease, risk factor or no risk factor) is one of the strengths of epidemiology. However, this approach is not sufficient for understanding health-care systems and the factors affecting outcomes. Fortunately, advances in systems engineering, computer science, and complexity research have produced new tools for understanding complex systems with important applications in patient safety and health-care quality promotion. It is now possible to mine the large data repositories that contain data from patients, providers, facilities, and plans to identify important trends, evaluate outcomes and costs, and detect associations that may lead to quality promotion interventions. New tools for data mining, which are adept at handling large and robust data sets and tolerate missing or sometimes inaccurate data elements, enhance the feasibility of this process and are already in use for evaluating emerging infections (7). Use of neural network analytic software is in its infancy, but several creative applications have demonstrated its utility, including clinical prediction rules to aid diagnosis (8,9). These and similar tools help generate new hypotheses that aid understanding of the system or lead to evaluation of new intervention targets.

### Beyond 2000

Times change, and CDC must change along with them. The Hospital Infections Program has redefined its mission—to protect patients, protect health-care personnel, and promote health-care quality—and initiated a reorganization to more effectively accomplish its priority program objectives. This process is reflected in the new name, Division of Healthcare Quality Promotion, which became effective January 1, 2001. The name change does not signal an end to more than four decades of successful infection prevention and control activities or a new move into “quality.” Rather, it reflects what always has been true: infection prevention is a critically important component of quality promotion. To paraphrase Dr. Richard Wenzel’s statement in 1990, infection control is the premier program for quality promotion in U.S. hospitals. It makes no sense to ask whether infection control should expand to include quality promotion; infection control has, from its inception, been quality promotion (10).

The core activities in health-care epidemiology and infection control—cluster and outbreak investigations, case-control studies to identify risk factors, surveillance and response, laboratory investigation, intervention efficacy and effectiveness studies—are tools with broad applicability to many domains of health-care quality. We can lend these tools to our colleagues in other disciplines and, in turn, benefit from their tools—root cause analysis, human factors research, hazards analysis, economic assessment—as we pursue common goals. We have a unique opportunity to experience, and, more importantly, to lead the development of consilience, the linkage of facts and fact-based theory across disciplines to create a common basis for new explanation or action, in health-care quality promotion (11).

First, the experience gained from preventing health care-associated infections must be generalized to encompass a broader set of adverse events. The progression is logical: from catheter-associated infections to device-associated infections to device-associated complications; likewise, from surgical site infections to procedure-associated infections to procedure-associated complications; from antimicrobial-drug resistance to medication complications. Together these three generic categories—device, procedure, and medication complications—account for most adverse events and medical errors that affect patient and provider safety, and hence are priority targets for quality promotion efforts. Building on the lessons learned from hospital infection control is one way to achieve rapid success in preventing these related complications. Second, multidisciplinary collaborations are essential to instigate innovative prevention research, identify new applications for old prevention strategies, maximize synergy among the broad array of professionals engaged in quality promotion efforts, minimize overlap, and conserve scarce resources.

In summary, health-care value purchasing, increasingly complex health-care systems, and information technology are the three most important change drivers that influenced the inter-related themes of the 4th Decennial Conference: accountability, quality promotion through infection prevention across the health-care delivery system, and medical informatics. Among the change drivers influencing the themes of the 5th International Conference may be a societal mandate for health promotion and health-care access for all. We can hope that market forces demand that “caring”—for patients and their providers—assumes the highest value in

health-care purchasing decisions. Until we put the caring back into the health-care delivery system, we cannot hope to be successful with any quality promotion effort.

Successful consilience among professionals with complementary skills and capacities working in concert to solve quality of care problems would be an exciting future theme. Prevention “success stories” would be another, perhaps including such topics as elimination of occupational needle injuries, complete adherence to immunization guidelines among patients and providers, and substantial reductions in the incidence of antimicrobial drug-resistant infections. Likewise, dramatic reductions in benchmark rates of infections, other adverse events, and medical errors in all health-care venues, a sign that successful measurement and prevention programs have been implemented across the entire system, would be a wonderful theme for the future. Finally, we may fervently hope that the 5th Decennial Conference will celebrate success in accomplishing the single most important factor necessary to promote health-care quality—a system that fosters joy and balance in the lives of health-care providers and the time for them to express their caring and concern for patients.

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